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PROGRAMING TEACHER-PUPIL INTERACTION PATTERNS.

BY- SIMON, ANITA AND OTHERS

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DESCRIPTORS- CLASSROOM BEHAVIOR, COMPUTER PROGRAMS, *COMPUTER ASSISTED INSTRUCTION, COOPERATING TEACHERS, DATA PROCESSING, *INTERACTION PROCESS ANALYSIS, LEARNING THEORIES, STUDENT TEACHER RELATIONSHIP, *STUDENT TEACHING, *TEACHER EDUCATION, *TEACHING STYLES, *TEACHING TECHNIQUES, FLANDERS SYSTEM OF INTERACTION ANALYSIS

TO DETERMINE WHAT EFFECTS A STUDENT TEACHER'S COURSE WORK HAS ON HIS ACTUAL CLASSROOM BEHAVIOR, 22 STUDENT TEACHERS WERE GIVEN 90 HOURS OF OBSERVATION AND BEHAVIOR TRAINING, WITH PARTICULAR EMPHASIS ON THE FLANDERS SYSTEM OF INTERACTION ANALYSIS. A CONTROL GROUP OF 22 STUDENTS WAS GIVEN TRAINING IN LEARNING THEORY. THE FLANDERS SYSTEM WAS USED TO OBSERVE EACH STUDENT TEACHER TWICE AT THE BEGINNING AND THE END OF THE STUDENT TEACHING EXPERIENCE. THE COOPERATING TEACHERS FOR THE FLANDERS GROUP WERE ALSO GIVEN TRAINING IN THIS SYSTEM. A COMPUTER PROGRAM WAS USED TO ISOLATE SPECIFIC PATTERNS OF STUDENT TEACHING BEHAVIOR WHICH COULD BE ATTRIBUTED TO TRAINING IN SYSTEMATIC CLASSROOM OBSERVATION AND TO MAKE EASIER THE SHEER WEIGHT OF DATA PROCESSING NECESSARY WITH THE FLANDERS SYSTEM. IT WAS FOUND THAT STUDENT TEACHERS TRAINED IN INTERACTION ANALYSIS TEND TO BE (1) MORE ACCEPTING, (2) LESS CRITICAL, (3) LESS DIRECTIVE, AND HAVE (4) MORE STUDENT INITIATED TALK, (5) MORE EXTENDED STUDENT INITIATED TALK, AND (6) LESS SILENCE AND CONFUSION IN THE CLASSROOM THAN STUDENT TEACHERS TRAINED IN LEARNING THEORY ALONE. IT IS CONCLUDED THAT (A) WHEN BOTH STUDENT AND COOPERATING TEACHERS KNOW INTERACTION ANALYSIS, THE STUDENTS HAVE A MAXIMUM OPPORTUNITY TO DEVELOP THEIR OWN STYLES OF TEACHING AND (B) INTERACTION ANALYSIS APPEARS TO INCREASE INDIVIDUALITY IN TEACHER BEHAVIOR. (AW)

1095

PROGRAMING TEACHER-PUPIL INTERACTION PATTERNS* **

by

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INTRODUCTION

Ordinarily when those educators responsible for teacher training anticipate the modification of teacher training programs, they think about changes in the structure and sequence of these programs. The assumption upon which this study rests is that changes in structure and sequence will themselves have little effect on the overt behavior of teachers or student teachers. Instead, we hypothesize that if teaching behavior is to be changed, then student teachers must have an opportunity to study their teaching, experiment with new teaching behaviors, and practice new teaching behaviors. Only when the focus of the teacher education program is on the teaching act itself can we expect any changes or improvement in the kinds of teachers we produce.

The study described in this paper was designed to give some answers to the following questions:

How can changes in overt behavior of student teachers be analyzed so that those concerned with student teaching can get a clearer picture of the outcomes of the student teaching experience? Which student teaching behaviors are likely to change when the focus of the course work taken

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concurrently with student teaching is on systematic classroom observation, behavior training and the role of the teacher in the classroom?

Although previous research has not provided answers to these questions, researchers such as Soar (33), Medley and Mitzel (31), Flanders (14), Bellack (12), Hughes (27), Amidon (6), Taba (39), and Gallagher and Aschner (22) have done research on teacher behavior and teacher pupil interaction patterns. In addition, Flanders (19) has applied the technique of classroom observation to the training of teachers in an inservice context. Amidon (3), Amidon and Others (1), Kirk (28), Furst (20), Zahn (42), and Hough (24) have adopted this idea of Flanders to the pre-service situation.

This study was designed to go beyond those just mentioned by using a computer program which would isolate specific patterns of student teaching behavior which can be attributed to training in systematic classroom observation. The main purpose of the study was to determine what effects the college course work taken by the student teacher had on his actual classroom teaching behaviors.

PROCEDURE

Forty-four student teachers were trained in this study. Half of the student teachers were given 90 hours per semester of observation and behavior training. The training focused on several systematic approaches to the study of classroom observation with the major emphasis on the Flanders System of Interaction Analysis. The other half of the student teachers were given training in Learning Theory. Training was also given to the cooperating teachers who supervised the student teachers in this study. Half of the cooperating teachers were given a course in which they learned the Flanders System of Interaction Analysis and its application to student teaching.

The Flanders System of Interaction Analysis was used to observe each student teacher two times at the beginning and again two times at the end of the student teaching experience.

Interaction Analysis is a procedure for collecting data on the teacher's verbal behavior in the classroom as he interacts with students. The end product of the observation is a series of columns of numbers which represent various categories of teacher and student talk, for example, praise, criticism, student initated ideas, and so forth. There are ten categories of teacher and student talk in this system. The categories are summarized on page 4.

CATEGORIES FOR INTERACTION ANALYSIS

Minnesota, 1959

TEACHER TALK	INDIRECT INFLUENCE	1.* ACCEPTS FEELING: accepts and clarifies the feeling tone of the students in a non-threatening manner. Feelings may be positive or negative. Predicting or recalling feelings are included.
		2.* PRAISES OR ENCOURAGES: praises or encourages student action or behavior. Jokes that release tension, not at the expense of another individual, nodding head or saying "um hm?" or "go on" are included.
		3.* ACCEPTS OR USES IDEAS OF STUDENT: clarifying, building, or developing ideas suggested by a student. As teacher brings more of his own ideas into play, shift to category five.
		4.* ASK QUESTIONS: asking a question about content or procedure with the intent that a student answer.
	DIRECT INFLUENCE	5.* LECTURING: giving facts or opinions about content or procedure; expressing his own ideas, asking rhetorical questions.
		6.* GIVING DIRECTIONS: directions, commands, or orders to which a student is expected to comply.
		7.* CRITICIZING OR JUSTIFYING AUTHORITY: statements intended to change student behavior from nonacceptable to acceptable pattern; bawling someone out; stating why the teacher is doing what he is doing; extreme self-reference.
		8.* STUDENT TALK--RESPONSE: talk by students in response to teacher. Teacher initiates the contact or solicits student statement.
		9.* STUDENT TALK--INITIATION: talk by students which they initiate. If calling on student is only to indicate who may talk next, observer must decide whether student wanted to talk. If he did, use this category.
		10.* SILENCE OR CONFUSION: pauses, short periods of silence and periods of confusion in which communication cannot be understood by the observer.

*There is NO scale implied by these numbers. Each number is classificatory, it designates a particular kind of communication event. To write these numbers down during observation is to enumerate, not to judge a position on a scale.

By reading down the columns of numbers collected by the observer, one obtains a picture of the sequence of verbal behaviors that occurred during the period being observed. These columns of numbers can be summarized in a ten by ten matrix which represents 100 possible sequence pairs of behaviors and reveals many of the patterns of interaction in the classroom of the teacher being observed. For example, if a teacher characteristically responds to a student initiated idea with praise, there will be a heavy buildup in the cell which represents the behavior pair (student initiates ideas - praise, 9-2) whereas if the teacher characteristically responds with criticism, a different cell (9-7) will receive a heavy loading. An example of the procedure for building a matrix follows:

Suppose that after the observer enters the classroom the following interaction takes place. The teacher says, "Boys and girls, sit down and open your workbooks" (category 6). One of the children says, "But, Mrs. Adams, I thought you said we were going to hear a story this morning" (category 9). The teacher reacts to Bill by saying, "Bill, you know the class was so noisy today that we decided to work in workbooks instead of hearing a story. I don't like it when you forget these things, Bill" (category 7). (The observer records two 7's in a row because of the length of the statement.) Then the teacher continues, "Now I think we can open our workbooks. Remember this new workbook is different from our old one." (The first part of the statement is a 6 and the last part, a 5.) The observer has recorded the following column of numbers, pairing them as shown below:

6
(9
7)
(7
6)
(5

These numbers are entered into the matrix in sequence pairs in such a way that each number is entered twice, once as the first number in a pair and once as the second number in a pair. The rows of the matrix represent the first number in the pair and the columns, the second number in the pair. For example, the first sequence pair, 6-9, would be tallied in the cell that is located at the intersection of row 6 and column 9. The next pair is entered in cell 9-7, the cell at the intersection of row 9 and column 7, the third pair 7-7, into the cell located at the intersection of row 7 and column 7, etc. Figure I shows the actual location of these five tallies in the matrix. (Figure I can be found below.)

Second event

First event	1	2	3	4	5	6	7	8	9	10	Tot.
1											
2											
3											
4											
5											
6					1				1		2
7						1	1				2
8											
9							1				1
10											
Tot.					1	1	2		1		

FIGURE I

SAMPLE MATRIX

The student teachers in this study learned to build and interpret matrices. They were then given feedback about their own teaching behavior by building matrices taken from tapes of their own classroom teaching. The student teachers determined from their matrices which behaviors they felt they needed to work on. The student teachers developed hypotheses about the effects of the new behaviors, and the hypotheses were tested back in the classroom.

DATA PROCESSING

One of the discouraging features of collecting live observational data is the tremendous amount of data to be processed. At least one tally is made every three seconds during the period of observation, and these tallies must be built into a matrix before data analysis can occur. Building the matrices is ordinarily a time consuming process. The computor program used in this project is made up of several sub-programs. The first sub-program, written by Soar, took raw tallies which were punched onto IBM cards and produced as output two individual teachers' matrices for each set of tallies put in. One matrix was a raw tally matrix such as would ordinarily be constructed if the matrices were built by hand. The second matrix was a percentage matrix. The value inside each cell indicates the percentage of the total matrix which is represented in the specific cell. In like manner, the row and total columns are given as percentages.

The second part of the program, constructed by Simon and Samph, drew out variables from the matrix to be further analyzed.

Once the raw tallies were fed into the computor, along with the program, two completed matrices plus 40 variables for each teacher were produced without any further hand calculation.

On the basis of Flanders' early research, a number of important cells were isolated for analysis. For example, Flanders had discovered that a buildup in the 3-3 cell was highly related to pupil achievement. Therefore, this sell was programmed for examination. Some other examples of variables programmed are column totals, amount of teacher and student talk, various indirect-direct ratios, and certain key cells and areas in the matrix. A complete listing of the variables is given in the appendix.

An additional program was constructed by Simon to produce group data from the individual data which was yeilded by the first program. This program produces an Averaged Group Matrix by summing the percentages in each cell, column, and row of the individual teachers matrix and dividing each sum by the number of teachers in the group. This program also gives an Average Score for the group on each of the variables produced by the original program. Thus the Averaged Group Matrix of two groups of subjects can be easily inspected for differences.

In summary, the first sub-program, builds a matrix from raw tallies and converts the raw tally matrix into a percentage matrix. The next sub-program computes and lists those elements of the matrix that the researcher wants to examine intensively. The third sub-program produces a matrix which contains in its cells, rows, and columns, the average percentages for the group being studied. Thus if there are ten teachers in a group, the Averaged Group Matrix will contain the average of the sums of the quantities on each of the teacher's individual matrices. This third sub-program can be used to compile the matrices of any number of teachers into one representatice matrix. The last sub-program computes and lists those elements of this Averaged Group Matrix which the researcher wishes to examine. These elements are the same as those which were computed for each individual teacher.

An example of an Averaged Group Matrix, plus the variables computed from this matrix are shown below.

EXAMPLE OF PERCENTAGE MATRIX FOR A GROUP OF TEN TEACHERS

.03	0.00	.00	.02	.07	.01	0.00	0.00	.04	0.00	.17
0.00	.29	1.44	.84	.89	.16	.05	1.86	1.37	.17	7.08
.01	1.25	1.53	1.78	1.89	.16	.14	.27	.51	.26	7.80
0.00	.65	.13	3.23	.92	.54	.15	5.56	2.02	.96	14.16
.05	1.00	.32	3.63	16.36	.92	.53	.41	1.51	1.31	26.04
0.00	.10	0.00	.72	.72	.65	.11	.85	.22	.70	4.07
.01	.08	.05	.17	.49	.20	.33	.14	.31	.39	2.17
.03	1.97	2.89	1.50	1.47	.43	.19	3.72	.45	.67	13.32
.04	1.44	1.36	1.12	2.14	.24	.31	.08	7.24	1.81	15.77
0.00	.29	.10	1.16	1.08	.75	.36	.43	2.10	3.15	9.42
.17	7.08	7.80	14.16	26.04	4.07	2.17	13.32	15.77	9.42	

EXAMPLE OF LISTING OF VARIABLES

VARIABLE NUMBER	CODE NAME*	AMOUNT
102	ST	29.10
103	TT	61.48
104	RID	2.40
105	BID	.90
106	RID8	7.88
107	BID8	3.05
108	RID9	5.16
109	BID9	1.47
110	RID89	6.60
111	BID89	2.16
112	XIN	4.55
113	XDI	1.29
114	XINDI	3.52
115	CRUX	24.14
116	CROSS	56.26
122	ZRIDS	.65
123	ZBIDS	.48
125	CRL67	2.38
126	SS17	22.42
127	SS89	10.96
128	SS19	33.38
129	COL 1	.17
130	COL 2	7.06

*Description of variables in Appendix. The Code Name is presented here for the reader's convenience. It is not listed as part of the output data. This is a partial listing of the variables.

PROBLEMS OF DATA PROCESSING

Many of the variables analyzed in this project were represented in the form of ratios. An example is the ratio of indirect-to-direct teacher talk, called the I/D ratio. However, the programming of these ratios causes special problems which are discussed in this section.

Consider the I/D ratio. When a teacher uses no direct talk, a zero will appear in the denominator of this ratio. This results in an undefined term which the computor will not process. Therefore, particular care must be taken when programming ratios. Several alternatives present themselves. 1) An "IF" statement can be written into the program so that the computor will merely print out the direct and indirect scores of teachers who have zero direct scores. The original program for this project was built in this manner. Later it was found that this solution produces many additional problems in data analysis caused primarily by the fact that some teachers have an I/D score and others have a separate direct and indirect score, but no I/D score. Therefore, further data analysis cannot easily be performed for any ratios which are handled in this manner. 2) To allow the use of data derived from scores of teachers who had zero denominators in any ratios, a .9 was arbitrarily plugged into the denominator of any ratio which otherwise would have been zero. This allowed for the use of the ratio score of that te r in the data. Dividing the numerator by .9 allows for the maintaining of the rank order of scores since an I/D ratio with a denominator of .9 is larger than one with a denominator of 1.0 (assumuming the same numerator in both cases). 3) A potentially more useful solution was suggested by Flanders who has constructed an I/D ratio which can never have a zero denominator. The new ratio uses the indirect categories for the numerator and the sum of the indirect and direct categories for the denominator. Thus, for example, the I/D ratio used in this program has been replaced in the revised program with $\frac{I}{I+D}$. All ratios have been handled in a similar manner in the revised program. This solution has the additional advantage of reducing the large variance caused by working with fractions (ratios) which have very small denominators. This becomes important when potentially statistically significant levels of differences between groups are not reached because of statistically artificially produced large variances. In addition, since the training of student teachers in the Flanders System did produce genuinely large variance within the trained groups, these new ratios are particularly useful and have been built into the new program.

An additional problem has been the mechanical factor of finding programs which differentiate between scores of zero and no data at all. For example, some library t-test programs will take a sample set of scores 12, 7, 3, 0, 0, and read them in as 12, 7, 3, with an N of 3 instead of the correct N of 5.

RESULTS

The results of this study support the research cited earlier. In over 85% of the tests of significances, the differences were in the expected direction. For example, 1) there is a tendency for student teachers trained in Interaction Analysis to be more accepting, less critical, and less directive than student teachers not trained in Interaction Analysis; 2) there is also a tendency for student teachers who learn Interaction Analysis to have more student initiated talk, more extended student initiated talk and less silence or confusion in their classroom than student teachers taught Learning Theory; 3) certain parts of the matrix significantly differentiate student teachers* who knew Interaction Analysis from student teachers who did not know Interaction Analysis. Some of these differences were: a) student teachers who knew Interaction Analysis were more indirect in their use of motivating and control behaviors

*at the .05 level

than those trained in Learning Theory, b) student teachers who were taught Interaction Analysis were more indirect in their overall teaching behaviors than student teachers not taught Interaction Analysis, c) student teachers who were taught Interaction Analysis used more extended indirect influence than student teachers who were taught Learning Theory, d) student teachers who were trained in Interaction Analysis used less extended direct influence than teachers who were trained in Learning Theory, e) student teachers who were trained in Interaction Analysis used more extended acceptance of student ideas than did student teachers trained in Learning Theory, and f) student teachers trained in Interaction Analysis had classes in which there was more extended student initiated talk than did student teachers trained in Learning Theory.

The difference in variances between two groups of student teachers is one of the most interesting brought to light so far. When the student teachers were compared on several variables (indirect-direct ratio, extended use of indirect influence, extended use of teacher acceptance of student ideas, and extended student initiated talk) the student teaching groups in which student teachers and cooperating teachers were both trained in Interaction Analysis, had from seven to fifteen times greater variabilty than the groups of student teachers who were untrained and whose cooperating teachers were untrained.

CONCLUSIONS

The research presented here indicated that Interaction Analysis trained student teachers are different from those not so trained. It is the direction of difference which is crucial. Those student teachers trained in Interaction Analysis have patterns like those teachers in the Flanders study whose pupils achieved more. This research is consistent with results of previous research by Zahn, Furst, Kirk, Hough, and Amidon.

Perhaps the most exciting implication of the results is that for most behaviors the Interaction Analysis group has greater variability than the non Interaction Analysis group. This seems to indicate that when student teachers know Interaction Analysis and their cooperating teachers know Interaction Analysis the student teachers are likely to have a maximum opportunity to develop their own styles of teaching. Thus Interaction Analysis appears to increase individuality in teacher behavior.

SOME COMMENTS CONCERNING USE OF COMPUTORS FOR ANALYSIS OF DATA

There are several advantages and disadvantages to handling data by computor processing rather than by hand calculation.

Advantages

1. Routine processing of large amounts of data can be handled with a minimum of clerical help. This allows for greatly increasing sample size without proportunately increasing the time or the money needed for data processing.

2. Once the processing of data is routinized, error is minimized.

3. Once the processing of data is routinized, complicated analysis of data which would be beyond the reach of most researchers due to time limitations can be handled easily with the use of library programs.

Disadvantages

1. Once the data processing procedure is mechanized, a minimum amount of attention is needed from the time the raw data is put on cards or tape until the time that the researcher gets finished output. However, a rather high degree of skill and knowledge is required to establish the procedure for processing data, to write the programs required, and to eliminate error from both the process and the programs.

2. Usually, data has to go through several steps of analysis, and the adaption of data from one step to the next is sometimes a complicated

procedure. This requires that a knowledgable person be available to help process data.

3. The ease and usefulness of processing data on a computor depends heavily on adequate facilities being available. Therefore, if access to modern facilities, and perhaps more important, adequate services are not available, the processing of data by computor will be time consuming.

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Variable Number	Code Name		**Interpretation	
NVAR 102 (Student talk)	ST	=	Percent student talk, Cols. 8-9	
NVAR 103 (Teacher talk)	TT	=	Percent teacher talk, Cols. 1-7	
NVAR 104 (Revised Indirect-Direct Ratio)	RID	=	$\frac{\text{Cols. } 1+2+3 \text{ (Indirect)}}{\text{Cols. } 6+7 \text{ (Direct)}}$	
	*RID	=	$\frac{\text{Cols. } 1+2+3}{\text{Cols. } 1+2+3+6+7}$	
NVAR 105 (Big Indirect-Direct Ratio)	BID	=	$\frac{\text{Cols. } 1+2+3+4}{\text{Cols. } 5+6+7}$	
	*BID	=	$\frac{\text{Cols. } 1+2+3+4}{\text{Cols. } 1+2+3+4+5+6+7}$	
NVAR 106	RID8	=	$\frac{\text{Cols. } 1+2+3}{\text{Cols. } 6+7}$	(for Row 8 only)
	*RID8	=	$\frac{\text{Cols. } 1+2+3}{\text{Cols. } 1+2+3+6+7}$	(for Row 8 only)
NVAR 107	BID8	=	$\frac{\text{Cols. } 1+2+3+4}{\text{Cols. } 5+6+7}$	(for Row 8 only)
	*BID8	=	$\frac{\text{Cols. } 1+2+3+4}{\text{Cols. } 1+2+3+4+5+6+7}$	(for Row 8 only)
NVAR 108	RID9	=	$\frac{\text{Cols. } 1+2+3}{\text{Cols. } 6+7}$	(for Row 9 only)
	*RID9	=	$\frac{\text{Cols. } 1+2+3}{\text{Cols. } 1+2+3+6+7}$	(for Row 9 only)
NVAR 109	BID9	=	$\frac{\text{Cols. } 1+2+3+4}{\text{Cols. } 5+6+7}$	(for Row 9 only)
	*BID9	=	$\frac{\text{Cols. } 1+2+3+4}{\text{Cols. } 1+2+3+4+5+6+7}$	(for Row 9 only)
NVAR 110	RID89	=	$\frac{\text{Cols. } 1+2+3}{\text{Cols. } 6+7}$	(for Sum of Rows 8 plus 9)
	*RID89	=	$\frac{\text{Cols. } 1+2+3}{\text{Cols. } 1+2+3+6+7}$	(for Sum of Rows 8 plus 9)

* These are the revised ratios as used in the revised I.A. Measures Program.

** All cells, columns and rows refer to a "percentage matrix" and not to a "raw tally matrix."

Variable Number	Code Name		**Interpretation
NVAR 111	BID89	=	$\frac{\text{Cols. } 1+2+3+4}{\text{Cols. } 5+6+7}$ (for Sum of Rows 8 plus 9)
	*BID89	=	$\frac{\text{Cols. } 1+2+3+4}{\text{Cols. } 1+2+3+4+5+6+7}$ (for Sum of Rows 8 plus 9)
NVAR 112 (Extended Indirect Area)	XIN	=	Cells 1-1+1-2+1-3+2-1+2-2+2-3+3-1+3-2+3-3
NVAR 113 (Extended Direct Area)	XDI	=	Cells 6-6+6-7+7-6+7-7
NVAR 114	XINDI	=	$\frac{\text{XIN (NVAR 112)}}{\text{XDI (NVAR 113)}}$
NVAR 115 (Center of the Content Cross)	CRUX	=	Cells 4-4+4-5+5-4+5-5
NVAR 116 (Content Cross)	CROSS	=	Columns 4 + 5 plus Rows 4 + 5 minus CRUX (NVAR 115)
NVAR 122	ZRIDS	=	$\frac{\text{RID9 (NVAR 108)}}{\text{RID8 (NVAR 106)}}$
NVAR 123	ZBIDS	=	$\frac{\text{BID9 (NVAR 109)}}{\text{BID8 (NVAR 107)}}$
NVAR 125	CRL67	=	XDI (NVAR 113) plus Cells 6-10+7-10
NVAR 126 (Study-state cells 1 - 7)	SS17	=	Cells 1-1+2-2+3-3+4-4+5-5+6-6+7-7
NVAR 127 (Extended student talk)	EXTST	=	Cells 8-8+8-9+9-8+9-9
NVAR 128	EX99F	=	$\frac{\text{EXTST (NVAR 127)}}{\text{Sum of Row 8 plus Row 9}}$
NVAR 129	COL1	=	Total column one
NVAR 130	COL2	=	Total column two
NVAR 131	COL3	=	Total column three
NVAR 132	COL4	=	Total column four
NVAR 133	COL5	=	Total column five

Variable Number	Code Name		**Interpretation
NVAR 134	COL6	=	Total column six
NVAR 135	COL7	=	Total column seven
NVAR 136	COL8	=	Total column eight
NVAR 137	COL9	=	Total column nine
NVAR 138	COL10	=	Total column ten
NVAR 139	C33	=	Cell 3-3
NVAR 140	C59	=	Cell 5-9
NVAR 141	C22	=	Cell 2-2
NVAR 142 (Extended 3-3 cell)	EX33	=	$\frac{\text{Cell 3-3}}{\text{Total of Row 3}}$
NVAR 143	EX33F	=	$\frac{\text{Cell 3-3}}{\text{Total Row 8 plus Row 9}}$
NVAR 148	C410	=	Cell 4-10
NVAR 149	C55	=	Cell 5-5
NVAR 150	C99	=	Cell 9-9
NVAR 153	Z4948	=	$\frac{\text{Cell 4-9}}{\text{Cell 4-8}}$